Science Kindergarten

Curriculum Guide 2022

Education

Newfoundland Labrador

Department of Education
Vision Statement

Building an educational community in Newfoundland and Labrador that fosters safe, inclusive, and healthy learning environments for all educators and students in the early learning, K-12, and post-secondary education systems.

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Section One: Newfoundland and Labrador Curriculum

Introduction

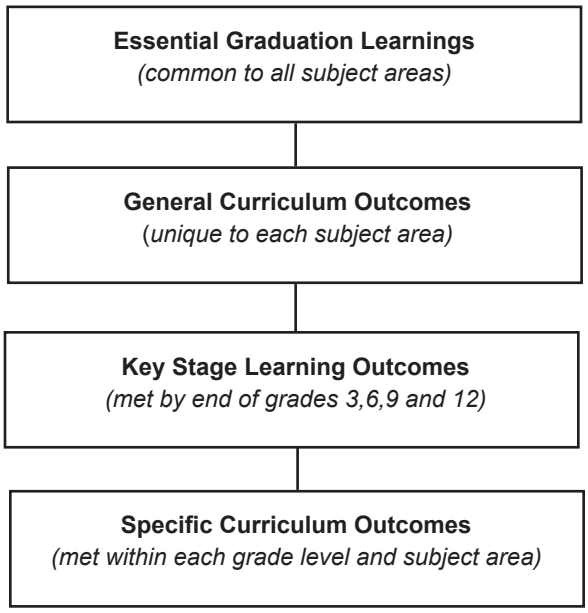
There are multiple factors that impact education: technological developments, increased emphasis on accountability, and globalization. These factors point to the need to consider carefully the education students receive.

The Newfoundland and Labrador Department of Education believes that curriculum design with the following characteristics will help teachers address the needs of students served by the provincially prescribed curriculum:

- Curriculum guides must clearly articulate what students are expected to know and be able to do by the time they graduate from high school.
- There must be purposeful assessment of students' performance in relation to the curriculum outcomes.

Outcomes Based Education

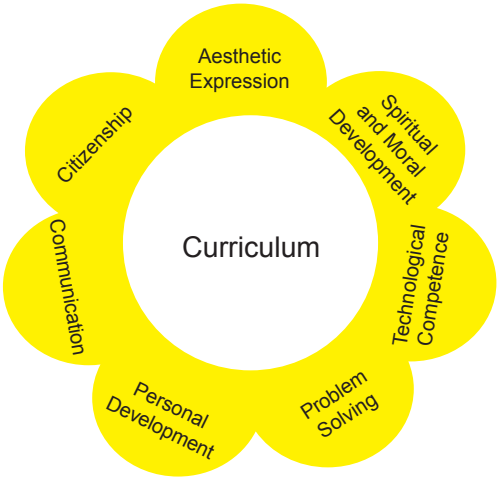
The K-12 curriculum in Newfoundland and Labrador is organized by outcomes and is based on *The Atlantic Canada Framework for Essential Graduation Learning in Schools* (1997). This framework consists of Essential Graduation Learnings (EGLs), General Curriculum Outcomes (GCOs), Key Stage Curriculum Outcomes (KSCOs) and Specific Curriculum Outcomes (SCOs).



Essential Graduation Learnings

EGLs provide vision for the development of a coherent and relevant curriculum. They are statements that offer students clear goals and a powerful rationale for education. The EGLs are delineated by general, key stage, and specific curriculum outcomes.

EGLs describe the knowledge, skills, and attitudes expected of all students who graduate from high school. Achievement of the EGLs will prepare students to continue to learn throughout their lives. EGLs describe expectations, not in terms of individual subject areas, but in terms of knowledge, skills, and attitudes developed throughout the K-12 curriculum. They confirm that students need to make connections and develop abilities across subject areas if they are to be ready to meet the shifting and ongoing demands of life, work, and study.



Aesthetic Expression – Graduates will be able to respond with critical awareness to various forms of the arts and be able to express themselves through the arts.

Citizenship – Graduates will be able to assess social, cultural, economic, and environmental interdependence in a local and global context.

Communication – Graduates will be able to use the listening, viewing, speaking, reading and writing modes of language(s), and mathematical and scientific concepts and symbols, to think, learn and communicate effectively.

Problem Solving – Graduates will be able to use the strategies and processes needed to solve a wide variety of problems, including those requiring language, and mathematical and scientific concepts.

Personal Development – Graduates will be able to continue to learn and to pursue an active, healthy lifestyle.

Spiritual and Moral Development – Graduates will demonstrate understanding and appreciation for the place of belief systems in shaping the development of moral values and ethical conduct.

Technological Competence – Graduates will be able to use a variety of technologies, demonstrate an understanding of technological applications, and apply appropriate technologies for solving problems.

Curriculum Outcomes

Curriculum outcomes are statements that articulate what students are expected to know and be able to do in each program area in terms of knowledge, skills, and attitudes.

Curriculum outcomes may be subdivided into General Curriculum Outcomes, Key Stage Curriculum Outcomes, and Specific Curriculum Outcomes.

General Curriculum Outcomes (GCOs)

Each program has a set of GCOs which describe what knowledge, skills, and attitudes students are expected to demonstrate as a result of their cumulative learning experiences within a subject area. GCOs serve as conceptual organizers or frameworks which guide study within a program area. Often, GCOs are further delineated into KSCOs.

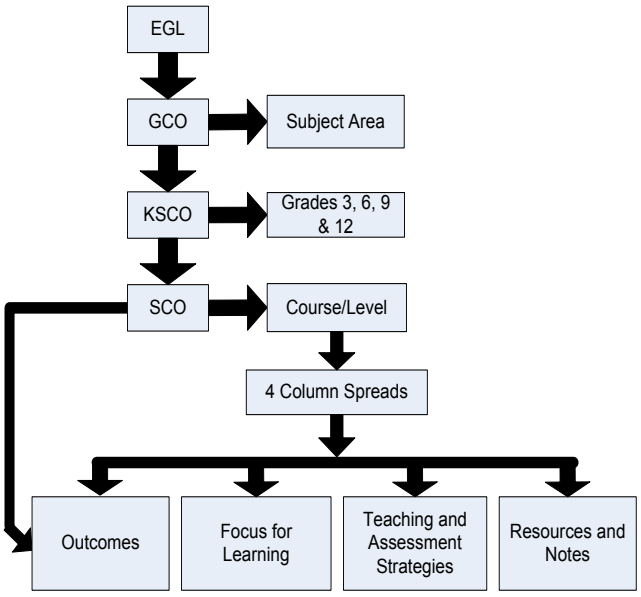
Key Stage Curriculum Outcomes (KSCOs)

Key Stage Curriculum Outcomes (KSCOs) summarize what is expected of students at each of the four key stages of grades three, six, nine, and twelve.

Specific Curriculum Outcomes (SCOs)

SCOs set out what students are expected to know and be able to do as a result of their learning experiences in a course, at a specific grade level. In some program areas, SCOs are further articulated into delineations. *It is expected that all SCOs will be addressed during the course of study covered by the curriculum guide.*

EGLs to Curriculum Guides



Context for Teaching and Learning

Teachers are responsible to help students achieve outcomes. This responsibility is a constant in a changing world. As programs change over time so does educational context. Several factors make up the educational context in Newfoundland and Labrador today: inclusive education, support for gradual release of responsibility teaching model, focus on literacy and learning skills in all programs, and support for education for sustainable development.

Inclusive Education

All students need to see their lives and experiences reflected in their school community. It is important that the curriculum reflect the experiences and values of all genders and that learning resources include and reflect the interests, achievements, and perspectives of all students. An inclusive classroom values the varied experiences and abilities as well as social and ethno-cultural backgrounds of all students while creating opportunities for community building. Inclusive policies and practices promote mutual respect, positive interdependencies, and diverse perspectives. Learning resources should include a range of materials that allow students to consider many viewpoints and to celebrate the diverse aspects of the school community.

Valuing Equity and Diversity

Effective inclusive schools have the following characteristics: supportive environment, positive relationships, feelings of competence, and opportunities to participate. (The Centre for Inclusive Education, 2009)

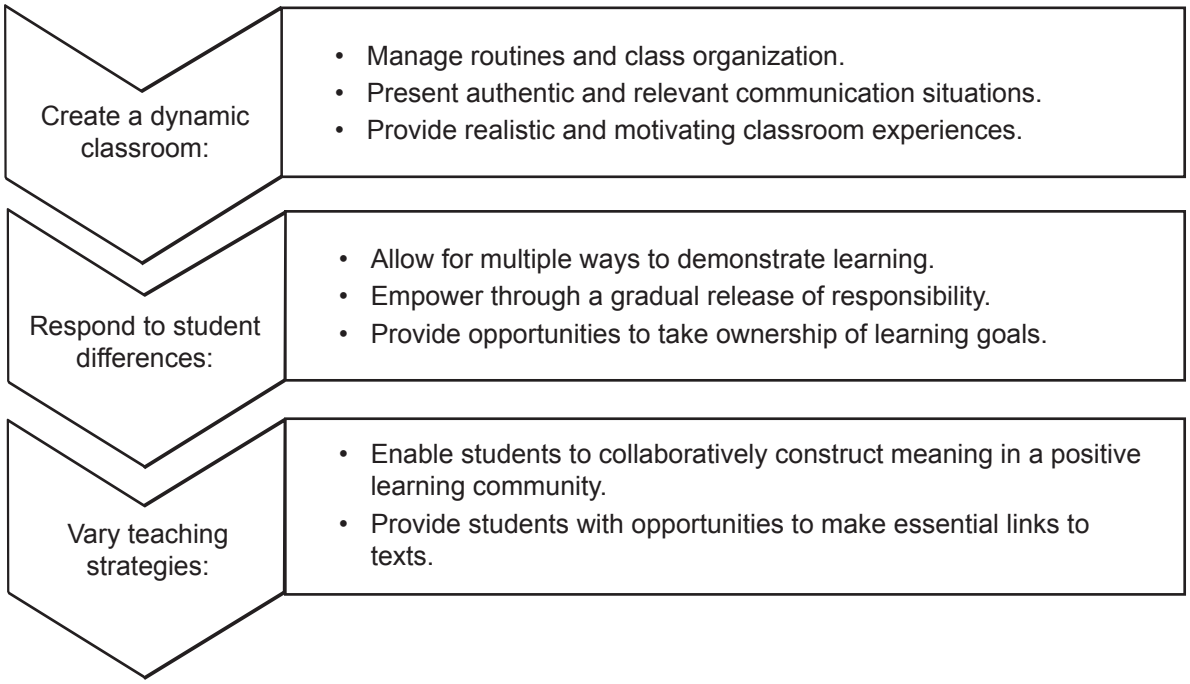
Differentiated Instruction

Differentiated instruction is a teaching philosophy based on the premise that teachers should adapt instruction to student differences. Rather than marching students through the curriculum lockstep, teachers should modify their instruction to meet students' varying readiness levels, learning preferences, and interests. Therefore, the teacher proactively plans a variety of ways to 'get it' and express learning. (Carol Ann Tomlinson, 2008)

Curriculum is designed and implemented to provide learning opportunities for all students according to abilities, needs, and interests. Teachers must be aware of and responsive to the diverse range of learners in their classes. Differentiated instruction is a useful tool in addressing this diversity.

Differentiated instruction responds to different readiness levels, abilities, and learning profiles of students. It involves actively planning so that the process by which content is delivered, the way the resource is used, and the products students create are in response to the teacher's knowledge of whom he or she is interacting with. Learning environments should be flexible to accommodate various learning preferences of the students. Teachers continually make decisions about selecting teaching strategies and structuring learning activities that provide all students with a safe and supportive place to learn and succeed.

Planning for Differentiation



Differentiating the Content

Differentiating content requires teachers to pre-assess students to identify those who require prerequisite instruction, as well as those who have already mastered the concept and may therefore apply strategies learned to new situations. Another way to differentiate content is to permit students to adjust the pace at which they progress through the material. Some students may require additional time while others will move through at an increased pace and thus create opportunities for enrichment or more indepth consideration of a topic of particular interest.

Teachers should consider the following examples of differentiating content:

- Meet with small groups to reteach an idea or skill or to extend the thinking or skills.
- Present ideas through auditory, visual, and tactile means.
- Use reading materials such as novels, websites, and other reference materials at varying reading levels.

Differentiating the Process

Differentiating the process involves varying learning activities or strategies to provide appropriate methods for students to explore and make sense of concepts. A teacher might assign all students the same product (e.g., presenting to peers) but the process students use to create the presentation may differ. Some students could work in groups while others meet with the teacher individually. The same assessment criteria can be used for all students.

Teachers should consider flexible grouping of students such as whole class, small group, or individual instruction. Students can be grouped according to their learning styles, readiness levels, interest areas, and/or the requirements of the content or activity presented. Groups should be formed for specific purposes and be flexible in composition and short-term in duration.

Teachers should consider the following examples of differentiating the process:

- Offer hands-on activities for students.
- Provide activities and resources that encourage students to further explore a topic of particular interest.
- Use activities in which all learners work with the same learning outcomes but proceed with different levels of support, challenge, or complexity.

Differentiating the Product

Differentiating the product involves varying the complexity and type of product that students create to demonstrate learning outcomes. Teachers provide a variety of opportunities for students to demonstrate and show evidence of what they have learned.

Teachers should give students options to demonstrate their learning (e.g., create an online presentation, write a letter, or develop a mural). This will lead to an increase in student engagement.

Differentiating the Learning Environment

The learning environment includes the physical and the affective tone or atmosphere in which teaching and learning take place, and can include the noise level in the room, whether student activities are static or mobile, or how the room is furnished and arranged. Classrooms may include tables of different shapes and sizes, space for quiet individual work, and areas for collaboration.

Teachers can divide the classroom into sections, create learning centres, or have students work both independently and in groups. The structure should allow students to move from whole group, to small group, pairs, and individual learning experiences and support a variety of ways to engage in learning. Teachers should be sensitive and alert to ways in which the classroom environment supports their ability to interact with students.

Teachers should consider the following examples of differentiating the learning environment:

- Develop routines that allow students to seek help when teachers are with other students and cannot provide immediate attention.
- Ensure there are places in the room for students to work quietly and without distraction, as well as places that invite student collaboration.
- Establish clear guidelines for independent work that match individual needs.
- Provide materials that reflect diversity of student background, interests, and abilities.

The physical learning environment must be structured in such a way that all students can gain access to information and develop confidence and competence.

Meeting the Needs of Students with Exceptionalities

All students have individual learning needs. Some students, however, have exceptionalities (defined by the Department of Education) which impact their learning. The majority of students with exceptionalities access the prescribed curriculum. For details of these exceptionalities see www.gov.nl.ca/edu/k12/studentsupportservices/exceptionalities.html

Supports for these students may include

1. Accommodations
2. Modified Prescribed Courses
3. Alternate Courses
4. Alternate Programs
5. Alternate Curriculum

For further information, see Service Delivery Model for Students with Exceptionalities at www.cdli.ca/sdm/

Classroom teachers should collaborate with instructional resource teachers to select and develop strategies which target specific learning needs.

Meeting the Needs of Students who are Highly Able

(includes gifted and talented)

Some students begin a course or topic with a vast amount of prior experience and knowledge. They may know a large portion of the material before it is presented to the class or be capable of processing it at a rate much faster than their classmates. All students are expected to move forward from their starting point. Many elements of differentiated instruction are useful in addressing the needs of students who are highly able.

Teachers may

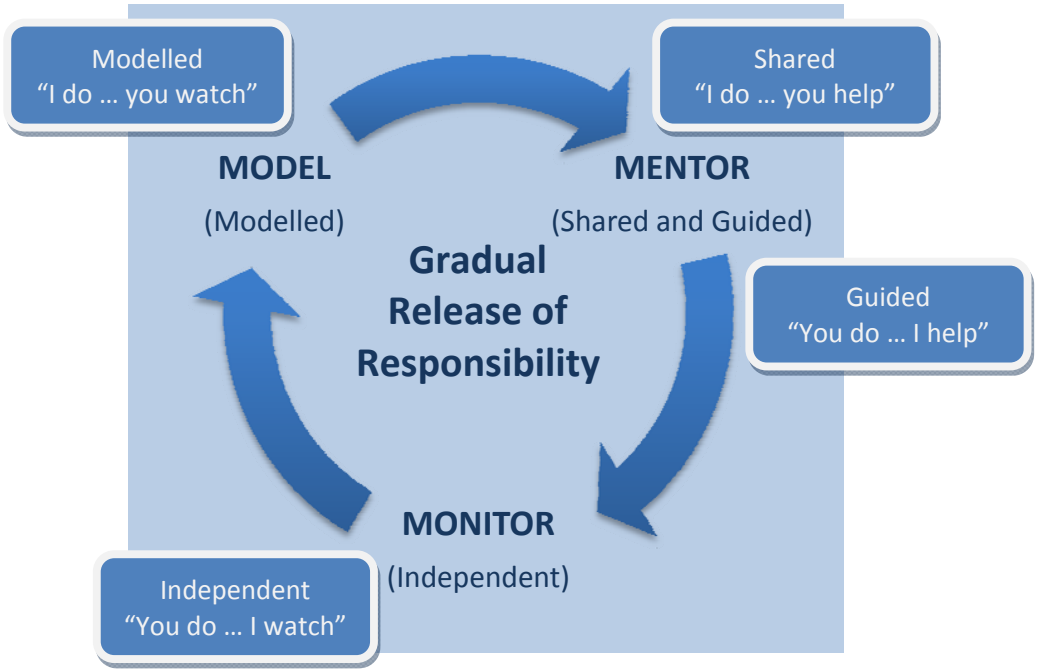
- assign independent study to increase depth of exploration in an area of particular interest;
- compact curriculum to allow for an increased rate of content coverage commensurate with a student's ability or degree of prior knowledge;
- group students with similar abilities to provide the opportunity for students to work with their intellectual peers and elevate discussion and thinking, or delve deeper into a particular topic; and
- tier instruction to pursue a topic to a greater depth or to make connections between various spheres of knowledge.

Highly able students require the opportunity for authentic investigation to become familiar with the tools and practices of the field of study. Authentic audiences and tasks are vital for these learners. Some highly able learners may be identified as gifted and talented in a particular domain. These students may also require supports through the Service Delivery Model for Students with Exceptionalities.

Gradual Release of Responsibility

Teachers must determine when students can work independently and when they require assistance. In an effective learning environment, teachers choose their instructional activities to model and scaffold composition, comprehension, and metacognition that is just beyond the students' independence level. In the gradual release of responsibility approach, students move from a high level of teacher support to independent work. If necessary, the teacher increases the level of support when students need assistance. The goal is to empower students with their own learning strategies, and to know how, when, and why to apply them to support their individual growth. Guided practice supports student independence. As a student demonstrates success, the teacher should gradually decrease his or her support.

Gradual Release of Responsibility Model



Literacy

"Literacy is the ability to identify, understand, interpret, create, communicate and compute, using printed and written materials associated with varying contexts. Literacy involves a continuum of learning in enabling individuals to achieve their goals, to develop their knowledge and potential, and to participate fully in their community and wider society". To be successful, students require a set of interrelated skills, strategies and knowledge in multiple literacies that facilitate their ability to participate fully in a variety of roles and contexts in their lives, in order to explore and interpret the world and communicate meaning. (The Plurality of Literacy and its Implications for Policies and Programmes, 2004, p.13)

Literacy is

- a process of receiving information and making meaning from it; and
- the ability to identify, understand, interpret, communicate, compute, and create text, images, and sounds.

Literacy development is a lifelong learning enterprise beginning at birth that involves many complex concepts and understandings. It is not limited to the ability to read and write; no longer are we exposed only to printed text. It includes the capacity to learn to communicate, read, write, think, explore, and solve problems. Individuals use literacy skills in paper, digital, and live interactions to engage in a variety of activities:

- Analyze critically and solve problems.
- Comprehend and communicate meaning.
- Create a variety of texts.
- Make connections both personally and inter-textually.
- Participate in the socio-cultural world of the community.
- Read and view for enjoyment.
- Respond personally.

These expectations are identified in curriculum documents for specific subject areas as well as in supporting documents, such as *Cross-Curricular Reading Tools* (CAMET).

With modelling, support, and practice, students' thinking and understandings are deepened as they work with engaging content and participate in focused conversations.

Reading in the Content Areas

The focus for reading in the content areas is on teaching strategies for understanding content. Teaching strategies for reading comprehension benefits all students as they develop transferable skills that apply across curriculum areas.

When interacting with different texts, students must read words, view and interpret text features, and navigate through information presented in a variety of ways including, but not limited to

Advertisements	Movies	Poems
Blogs	Music videos	Songs
Books	Online databases	Speeches
Documentaries	Plays	Video games
Magazine articles	Podcasts	Websites

Students should be able to interact with and comprehend different texts at different levels.

There are three levels of text comprehension:

- Independent level – Students are able to read, view, and understand texts without assistance.
- Instructional level – Students are able to read, view, and understand most texts but need assistance to fully comprehend some texts.
- Frustration level – Students are not able to read or view with understanding (i.e., texts may be beyond their current reading level).

Teachers will encounter students working at all reading levels in their classrooms and will need to differentiate instruction to meet their needs. For example, print texts may be presented in audio form, physical movement may be associated with synthesizing new information with prior knowledge, or graphic organizers may be created to present large amounts of print text in a visual manner.

When interacting with information that is unfamiliar to students, it is important for teachers to monitor how effectively students are using strategies to read and view texts:

- Analyze and think critically about information.
- Determine importance to prioritize information.
- Engage in questioning before, during, and after an activity related to a task, text, or problem.
- Make inferences about what is meant but not said.
- Make predictions.
- Synthesize information to create new meaning.
- Visualize ideas and concepts.

Learning Skills for Generation Next

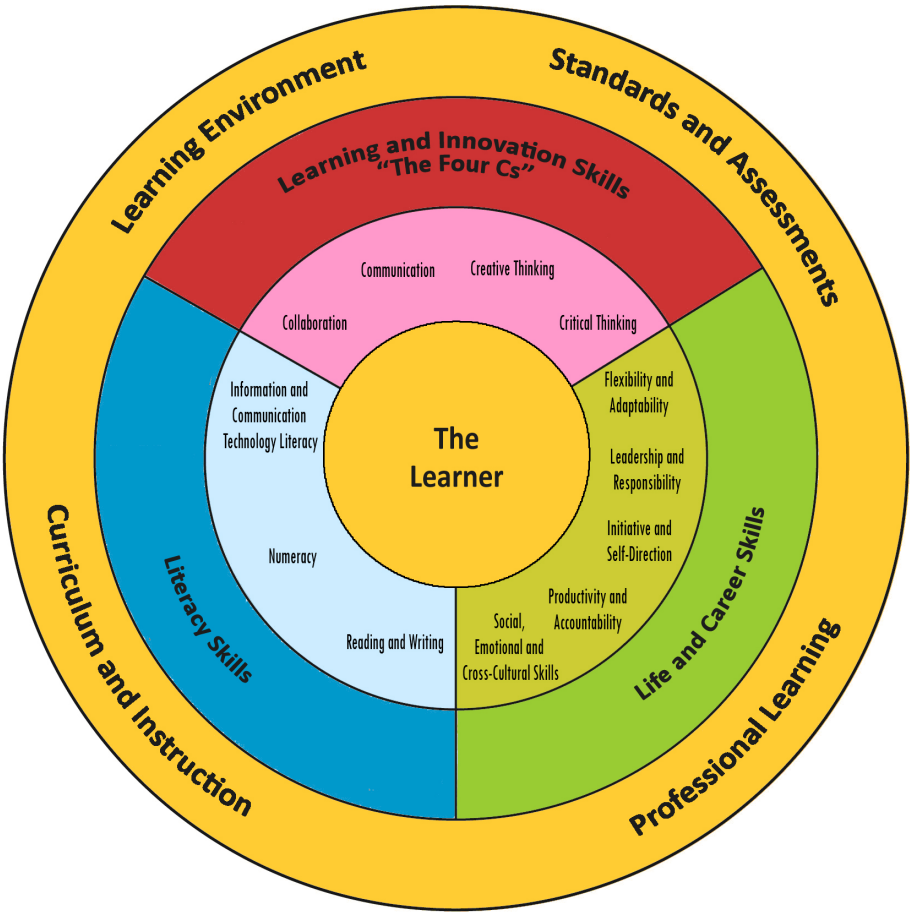
Generation Next is the group of students who have not known a world without personal computers, cell phones, and the Internet. They were born into this technology. They are digital natives.

Students need content and skills to be successful. Education helps students learn content and develop skills needed to be successful in school and in all learning contexts and situations. Effective learning environments and curricula challenge learners to develop and apply key skills within the content areas and across interdisciplinary themes.

Learning Skills for Generation Next encompasses three broad areas:

- Learning and Innovation Skills enhance a person's ability to learn, create new ideas, problem solve, and collaborate.
- Life and Career Skills address leadership, and interpersonal and affective domains.
- Literacy Skills develop reading, writing, and numeracy, and enhance the use of information and communication technology.

The diagram below illustrates the relationship between these areas. A 21st century curriculum employs methods that integrate innovative and research-driven teaching strategies, modern learning technologies, and relevant resources and contexts.



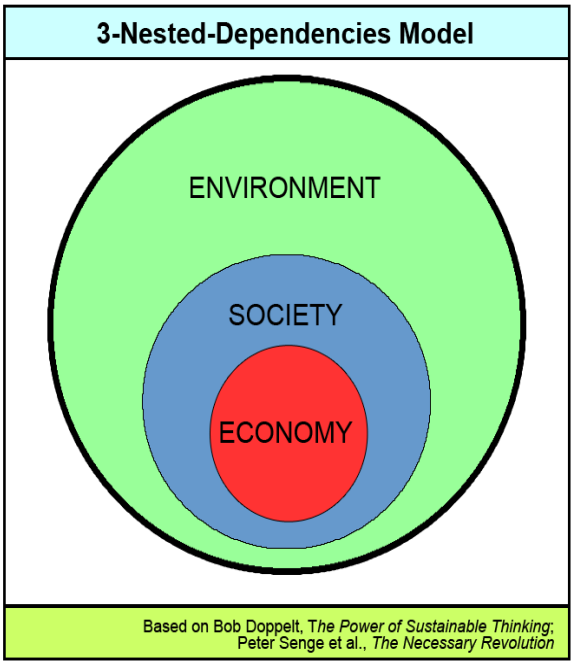
Support for students to develop these abilities and skills is important across curriculum areas and should be integrated into teaching, learning, and assessment strategies. Opportunities for integration of these skills and abilities should be planned with engaging and experiential activities that support the gradual release of responsibility model. For example, lessons in a variety of content areas can be infused with learning skills for Generation Next by using open-ended questioning, role plays, inquiry approaches, self-directed learning, student role rotation, and Internet-based technologies.

All programs have a shared responsibility in developing students' capabilities within all three skill areas.

Education for Sustainable Development

Sustainable development is defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs". (Our Common Future, 43)

Sustainable development is comprised of three integrally connected areas: economy, society, and environment.



As conceived by the United Nations Educational, Scientific, and Cultural Organization (UNESCO) the overall goal of Education for Sustainable Development (ESD) is to integrate the knowledge, skills, values, and perspectives of sustainable development into all aspects of education and learning. Changes in human behaviour should create a more sustainable future that supports environmental integrity and economic viability, resulting in a just society for all generations.

ESD involves teaching *for* rather than teaching *about* sustainable development. In this way students develop the skills, attitudes, and perspectives to meet their present needs without compromising the ability of future generations to meet their needs.

Within ESD, the knowledge component spans an understanding of the interconnectedness of our political, economic, environmental, and social worlds, to the role of science and technology in the development of societies and their impact on the environment. The skills necessary include being able to assess bias, analyze consequences of choices, ask questions, and solve problems. ESD values and perspectives include an appreciation for the interdependence of all life forms, the importance of individual responsibility and action, an understanding of global issues as well as local issues in a global context. Students need to be aware that every issue has a history, and that many global issues are linked.

Assessment and Evaluation

Assessment

Assessment is the process of gathering information on student learning.

How learning is assessed and evaluated and how results are communicated send clear messages to students and others about what is valued.

Assessment instruments are used to gather information for evaluation. Information gathered through assessment helps teachers determine students' strengths and needs, and guides future instruction.

Teachers are encouraged to be flexible in assessing student learning and to seek diverse ways students might demonstrate what they know and are able to do.

Evaluation involves the weighing of the assessment information against a standard in order to make a judgement about student achievement.

Assessment can be used for different purposes:

1. Assessment *for* learning guides and informs instruction.
2. Assessment *as* learning focuses on what students are doing well, what they are struggling with, where the areas of challenge are, and what to do next.
3. Assessment *of* learning makes judgements about student performance in relation to curriculum outcomes.

1. Assessment for Learning

Assessment *for* learning involves frequent, interactive assessments designed to make student learning visible. This enables teachers to identify learning needs and adjust teaching accordingly. Assessment *for* learning is not about a score or mark; it is an ongoing process of teaching and learning:

- Pre-assessments provide teachers with information about what students already know and can do.
- Self-assessments allow students to set goals for their own learning.
- Assessment *for* learning provides descriptive and specific feedback to students and parents regarding the next stage of learning.
- Data collected during the learning process from a range of tools enables teachers to learn as much as possible about what a student knows and is able to do.

2. Assessment as Learning

Assessment *as* learning involves students' reflecting on their learning and monitoring their own progress. It focuses on the role of the student in developing metacognition and enhances engagement in their own learning. Students can

- analyze their learning in relation to learning outcomes,
- assess themselves and understand how to improve performance,
- consider how they can continue to improve their learning, and
- use information gathered to make adaptations to their learning processes and to develop new understandings.

3. Assessment of Learning

Assessment *of* learning involves strategies designed to confirm what students know in terms of curriculum outcomes. It also assists teachers in determining student proficiency and future learning needs. Assessment *of* learning occurs at the end of a learning experience and contributes directly to reported results. Traditionally, teachers relied on this type of assessment to make judgements about student performance by measuring learning after the fact and then reporting it to others. Used in conjunction with the other assessment processes previously outlined, assessment *of* learning is strengthened. Teachers can

- confirm what students know and can do;
- report evidence to parents/guardians, and other stakeholders, of student achievement in relation to learning outcomes; and
- report on student learning accurately and fairly using evidence obtained from a variety of contexts and sources.

Involving Students in the Assessment Process

Students should know what they are expected to learn as outlined in the specific curriculum outcomes of a course as well as the criteria that will be used to determine the quality of their achievement. This information allows students to make informed choices about the most effective ways to demonstrate what they know and are able to do.

It is important that students participate actively in assessment by co-creating criteria and standards which can be used to make judgements about their own learning. Students may benefit from examining various scoring criteria, rubrics, and student exemplars.

Students are more likely to perceive learning as its own reward when they have opportunities to assess their own progress. Rather than asking teachers, "What do you want?", students should be asking themselves questions:

- What have I learned?
- What can I do now that I couldn't do before?
- What do I need to learn next?

Assessment must provide opportunities for students to reflect on their own progress, evaluate their learning, and set goals for future learning.

Assessment Tools

In planning assessment, teachers should use a broad range of tools to give students multiple opportunities to demonstrate their knowledge, skills, and attitudes. The different levels of achievement or performance may be expressed as written or oral comments, ratings, categorizations, letters, numbers, or as some combination of these forms.

The grade level and the activity being assessed will inform the types of assessment tools teachers will choose:

Anecdotal Records	Photographic Documentation
Audio/Video Clips	Podcasts
Case Studies	Portfolios
Checklists	Presentations
Conferences	Projects
Debates	Questions
Demonstrations	Quizzes
Exemplars	Role Plays
Graphic Organizers	Rubrics
Journals	Self-assessments
Literacy Profiles	Tests
Observations	Wikis

Assessment Guidelines

Assessments should measure what they intend to measure. It is important that students know the purpose, type, and potential marking scheme of an assessment. The following guidelines should be considered:

- Collect evidence of student learning through a variety of methods; do not rely solely on tests and paper and pencil activities.
- Develop a rationale for using a particular assessment of learning at a specific point in time.
- Provide descriptive and individualized feedback to students.
- Provide students with the opportunity to demonstrate the extent and depth of their learning.
- Set clear targets for student success using learning outcomes and assessment criteria.
- Share assessment criteria with students so that they know the expectations.

Evaluation

Evaluation is the process of analyzing, reflecting upon, and summarizing assessment information, and making judgements or decisions based on the information gathered. Evaluation is conducted within the context of the outcomes, which should be clearly understood by learners before teaching and evaluation take place. Students must understand the basis on which they will be evaluated and what teachers expect of them.

During evaluation, the teacher interprets the assessment information, makes judgements about student progress, and makes decisions about student learning programs.

Section Two: Curriculum Design

Rationale

The vision of science education in Newfoundland and Labrador is to develop scientific literacy.

> *Scientific literacy is an evolving combination of the science-related attitudes, skills, and knowledge students need to develop inquiry, problem solving, and decision making abilities; to become lifelong learners; and to maintain a sense of wonder about the world around them.*

To develop scientific literacy, students require diverse learning experiences which provide opportunities to explore, analyze, evaluate, synthesize, appreciate, and understand the interrelationships among science, technology, society, and the environment that will affect their personal lives, careers, and futures.

Science education which strives for scientific literacy must engage students in science inquiry, problem solving, and decision making.

Science Inquiry

Science inquiry involves posing questions and developing explanations for phenomena. While there is general agreement that there is no such thing as “the” scientific method, students require certain skills to participate in the activities of science. Skills such as questioning, observing, inferring, predicting, measuring, hypothesizing, classifying, designing experiments, collecting data, analyzing data, and interpreting data are fundamental to engaging in science. These skills are often represented as a cycle which involves the posing of questions, the generation of possible explanations, and the collection of evidence to determine which of these explanations is most useful in accounting for the phenomenon under investigation. Teachers should engage students in science inquiry activities to develop these skills.

Problem Solving

Problem solving involves seeking solutions to human problems. It may be represented as a cycle consisting of the proposing, creating, and testing of prototypes, products, and techniques in an attempt to reach an optimum solution to a given problem. The skills involved in this cycle facilitate a process which has different aims and procedures from science inquiry. Students should be given opportunities to propose, perform, and evaluate solutions to problem solving or technological tasks.

Decision Making

Decision making involves determining what we should do in a particular context or in response to a given situation. Increasingly, the types of problems that we deal with, both individually and collectively, require an understanding of the processes and products of science and technology. The process of decision making involves identification of the problem or situation, generation of possible solutions or courses of action, evaluation of the alternatives, and a thoughtful decision based on the information available. Students should be actively involved in decision making situations. While important in their own right, decision making situations also provide a relevant context for engaging in science inquiry and/or problem solving.

Curriculum Outcomes Framework

The foundation of the curriculum outcomes framework is the general curriculum outcomes (GCOs). Four general curriculum outcomes have been identified to delineate the four critical aspects of students' scientific literacy: science, technology, society, and the environment (STSE), skills, knowledge, and attitudes. These four GCOs are common to all science courses.

General Curriculum Outcomes

GCO 1: STSE - develop an understanding of the nature of science and technology, of the relationships between science and technology, and of the social and environmental contexts of science and technology.

GCO 2: Skills - develop the skills required for scientific and technological inquiry, for solving problems, for communicating scientific ideas and results, for working collaboratively, and for making informed decisions.

GCO 3: Knowledge - construct knowledge and understandings of concepts in life science, physical science, and Earth and space science, and apply these understandings to interpret, integrate, and extend their knowledge.

GCO 4: Attitudes - be encouraged to develop attitudes that support the responsible acquisition and application of scientific and technological knowledge to the mutual benefit of self, society, and the environment.

For Science K-3, general and specific curriculum outcomes for STSE and knowledge are combined (i.e., STSE/Knowledge).

Key Stage Curriculum Outcomes

Key stage curriculum outcomes (KSCOs) align with the GCOs and summarize what students are expected to know and be able to do by the end of Grades 3, 6, 9, and 12.

GCO 1/3: STSE/Knowledge

By the end of Grade 3, students will be expected to

- investigate objects and events in their immediate environment, and use appropriate language to develop understanding and to communicate results;
- demonstrate and describe ways of using materials and tools to help answer science questions and to solve practical problems;
- describe how science and technology affect their lives and those of people and other living things in their community; and
- undertake personal actions to care for their immediate environment and contribute to responsible group decisions.

GCO 2: Skills

By the end of Grade 3, students will be expected to

- ask questions about objects and events in their immediate environment and develop ideas about how those questions might be answered;
- observe and explore materials and events in their immediate environment and record the results;
- identify patterns and order in objects and events studied; and
- work with others and share and communicate ideas about their explorations.

GCO 4: Attitudes

By the end of Grade 3, students will be expected to

- recognize the role and contribution of science in their understanding of the world;
- show interest in and curiosity about objects and events within their immediate environment;
- willingly observe, question, and explore;
- consider their own observations and their own ideas when drawing a conclusion;
- appreciate the importance of accuracy;
- be open-minded in their explorations;
- work with others in exploring and investigating;
- be sensitive to the needs of other people, other living things, and the local environment; and
- show concern for their safety and that of others in carrying out activities and using materials.

Specific Curriculum Outcomes

Specific curriculum outcomes (SCOs) align to KSCOs and GCOs and describe what students should know and be able to do at the end of each course. They are intended to serve as the focus for the design of learning experiences and assessment tasks.

Course Overview

The kindergarten science curriculum is curiosity-driven. **Learning experiences are not prescribed**. The objects and events that students are interested in become the focus of learning experiences to address curriculum expectations within a play- and inquiry-based environment.

Suggested Yearly Plan

SCOs are presented in a single unit; *Exploring Our World.*

Students engage in ongoing, iterative cycles of independent and collaborative science inquiry and problem solving, including design and builds, based on their personal interests and curiosities.

September	October	November	December	January	February	March	April	May	June
Exploring Our World									

How to Use the Four Column Curriculum Layout

Outcomes

Column one contains specific curriculum outcomes (SCO) and accompanying delineations where appropriate. The delineations provide specificity in relation to key ideas.

Outcomes are numbered in ascending order.

Delineations are indented and numbered as a subset of the originating SCO.

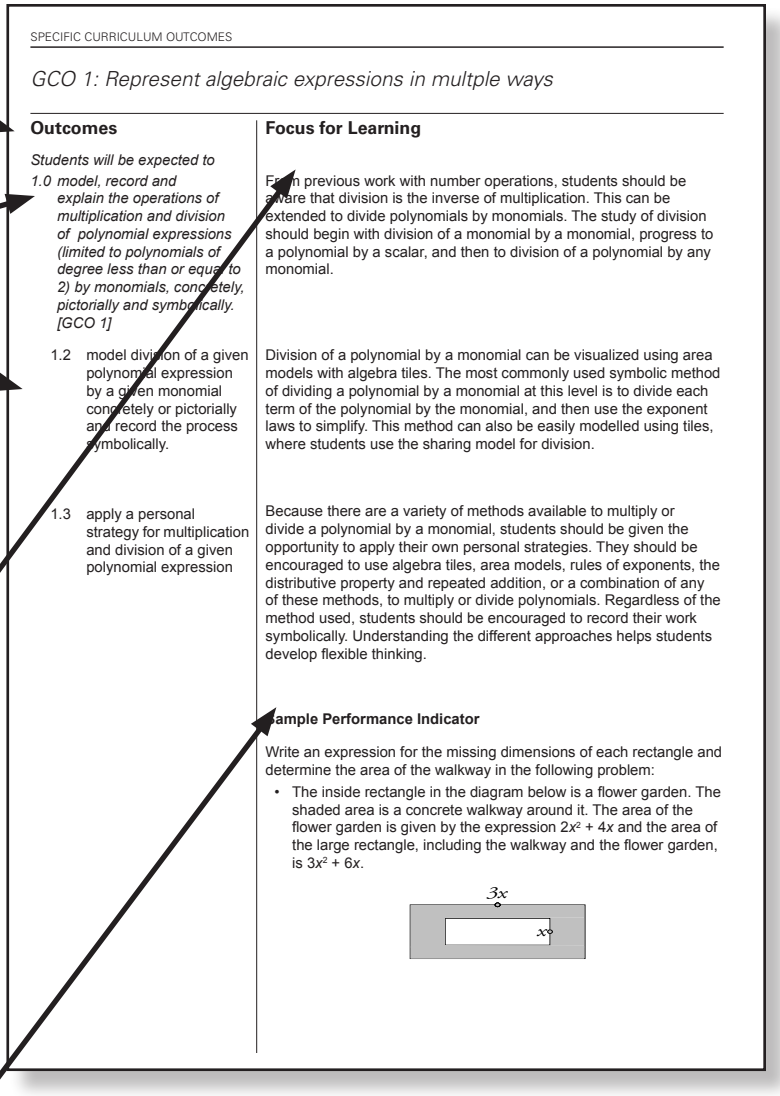
All outcomes are related to general curriculum outcomes.

Focus for Learning

Column two is intended to assist teachers with instructional planning. It also provides context and elaboration of the ideas identified in the first column.

This may include

- cautionary notes
- clarity in terms of scope
- common misconceptions
- depth of treatment
- knowledge required to scaffold and challenge student's learning
- references to prior knowledge



SPECIFIC CURRICULUM OUTCOMES

GCO 1: Represent algebraic expressions in multple ways

Outcomes	Focus for Learning
Students will be expected to	
1.0 model, record and explain the operations of multiplication and division of polynomial expressions (limited to polynomials of degree less than or equal to 2) by monomials, concretely, pictorially and symbolically. [GCO 1]	From previous work with number operations, students should be aware that division is the inverse of multiplication. This can be extended to divide polynomials by monomials. The study of division should begin with division of a monomial by a monomial, progress to a polynomial by a scalar, and then to division of a polynomial by any monomial.
1.2 model division of a given polynomial expression by a given monomial concretely or pictorially and record the process symbolically.	Division of a polynomial by a monomial can be visualized using area models with algebra tiles. The most commonly used symbolic method of dividing a polynomial by a monomial at this level is to divide each term of the polynomial by the monomial, and then use the exponent laws to simplify. This method can also be easily modelled using tiles, where students use the sharing model for division.
1.3 apply a personal strategy for multiplication and division of a given polynomial expression	Because there are a variety of methods available to multiply or divide a polynomial by a monomial, students should be given the opportunity to apply their own personal strategies. They should be encouraged to use algebra tiles, area models, rules of exponents, the distributive property and repeated addition, or a combination of any of these methods, to multiply or divide polynomials. Regardless of the method used, students should be encouraged to record their work symbolically. Understanding the different approaches helps students develop flexible thinking.

Sample Performance Indicator

Write an expression for the missing dimensions of each rectangle and determine the area of the walkway in the following problem:

- The inside rectangle in the diagram below is a flower garden. The shaded area is a concrete walkway around it. The area of the flower garden is given by the expression $2x^2 + 4x$ and the area of the large rectangle, including the walkway and the flower garden, is $3x^2 + 6x$.

Sample Performance Indicator(s)

This provides a summative, higher order activity, where the response would serve as a data source to help teachers assess the degree to which the student has achieved the outcome.

Performance indicators are typically presented as a task, which may include an introduction to establish a context. They would be assigned at the end of the teaching period allocated for the outcome.

Performance indicators would be assigned when students have attained a level of competence, with suggestions for teaching and assessment identified in column three.

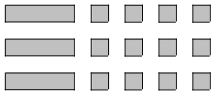
SPECIFIC CURRICULUM OUTCOMES

GCO 1: Represent algebraic expressions in multple ways

Sample Teaching and Assessment Strategies

Teachers may use the following activities and/or strategies aligned with the corresponding assessment tasks:

Modeling division using the sharing model provides a good transition to the symbolic representation. For example, $\frac{3x+12}{3} = \frac{3x}{3} + \frac{12}{3}$. To model this, students start with a collection of three x-tiles and 12 unit tiles and divide them into three groups.



For this example, $x + 4$ tiles will be a part of each group, so the quotient is $x + 4$.

Activation

Students may

- Model division of a polynomial by a monomial by creating a rectangle using four x^2-tiles and eight x-tiles, where $4x$ is one of the dimensions.

Teachers may

- Ask students what the other dimension is and connect this to the symbolic representation.

Connection

Students may

- Model division of polynomials and determine the quotient
  - (i) $(6x^2 + 12x - 3) \div 3$
  - (ii) $(4x^2 - 12x) \div 4x$

Consolidation

Students may

- Draw a rectangle with an area of $36a^2 + 12a$ and determine as many different dimensions as possible.

Teachers may

- Discuss why there are so many different possible dimensions.

Extension

Students may

- Determine the area of one face of a cube whose surface area is represented by the polynomial $24s^2$.
- Determine the length of an edge of the cube.

Resources and Notes

Authorized

- *Math Makes Sense 9*
- Lesson 5.5: Multiplying and Dividing a Polynomial by a Constant
- Lesson 5.6: Multiplying and Dividing a Polynomial by a Monomial
- ProGuide: pp. 35-42, 43-51
- CD-ROM: Master 5.23, 5.24
- See It Videos and Animations:
- Multiplying and Dividing a Polynomial by a Constant, Dividing
- Multiplying and Dividing a Polynomial by a Monomial, Dividing
- SB: pp. 241-248, 249-257
- PB: pp. 206-213, 214-219

Resources and Notes

Column four references supplementary information and possible resources for use by teachers.

These references will provide details of resources suggested in column two and column three.

Suggestions for Teaching and Assessment

This column contains specific sample tasks, activities, and strategies that enable students to meet the goals of the SCOs and be successful with performance indicators. Instructional activities are recognized as possible sources of data for assessment purposes. Frequently, appropriate techniques and instruments for assessment purposes are recommended.

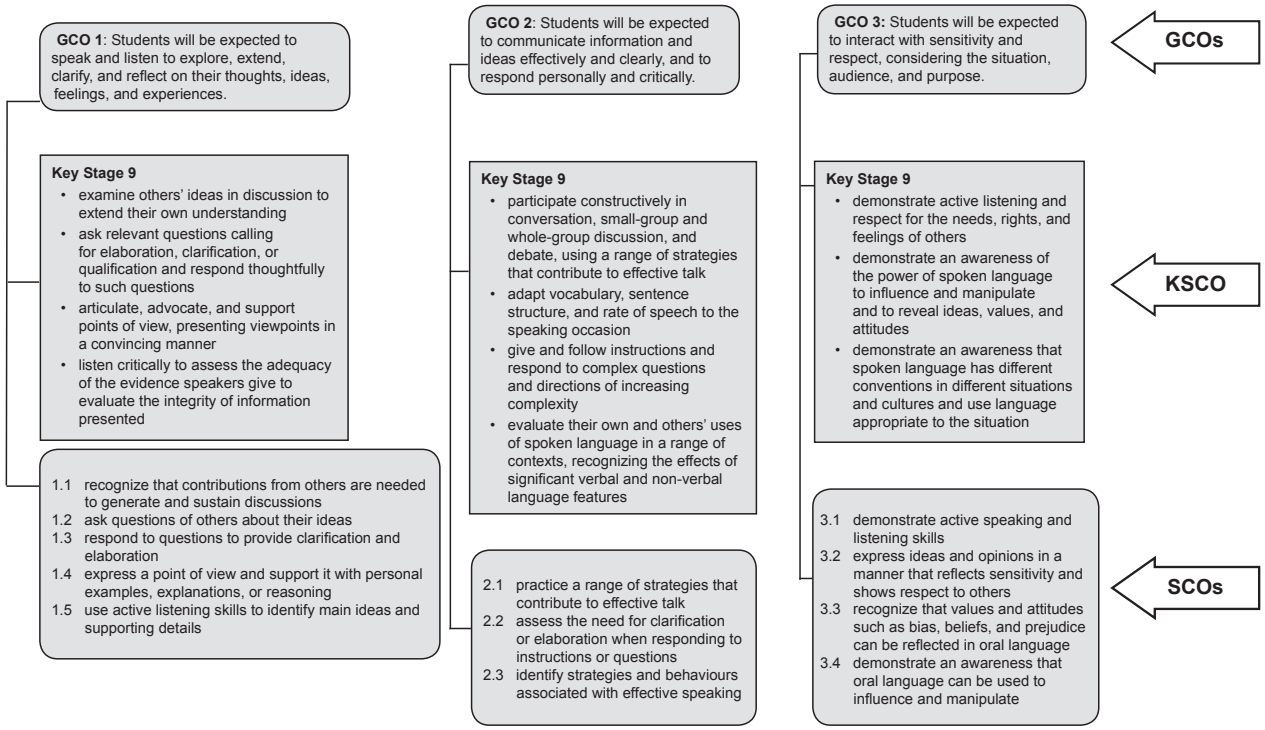
Suggestions for instruction and assessment are organized sequentially:

- Activation – suggestions that may be used to activate prior learning and establish a context for the instruction
- Connection – linking new information and experiences to existing knowledge inside or outside the curriculum area
- Consolidation – synthesizing and making new understandings
- Extension – suggestions that go beyond the scope of the outcome

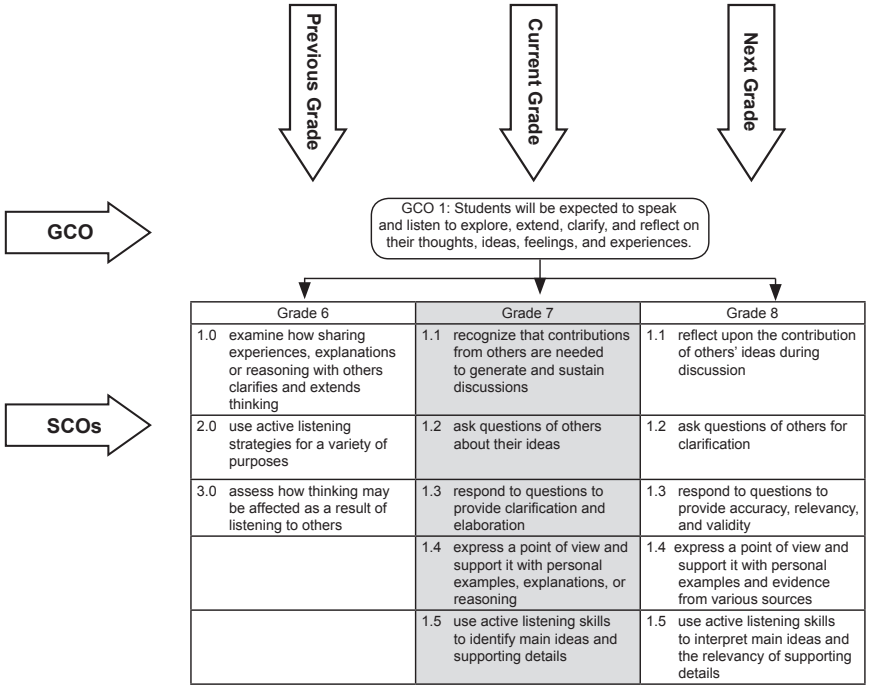
These suggestions provide opportunities for differentiated learning and assessment.

How to use a Strand overview

At the beginning of each strand grouping there is explanation of the focus for the strand and a flow chart identifying the relevant GCOs, KSCOs and SCOs.



The SCOs Continuum follows the chart to provide context for teaching and assessment for the grade/ course in question. The current grade is highlighted in the chart.



Grade 6	Grade 7	Grade 8
1.0 examine how sharing experiences, explanations or reasoning with others clarifies and extends thinking	1.1 recognize that contributions from others are needed to generate and sustain discussions	1.1 reflect upon the contribution of others' ideas during discussion
2.0 use active listening strategies for a variety of purposes	1.2 ask questions of others about their ideas	1.2 ask questions of others for clarification
3.0 assess how thinking may be affected as a result of listening to others	1.3 respond to questions to provide clarification and elaboration	1.3 respond to questions to provide accuracy, relevancy, and validity
	1.4 express a point of view and support it with personal examples, explanations, or reasoning	1.4 express a point of view and support it with personal examples and evidence from various sources
	1.5 use active listening skills to identify main ideas and supporting details	1.5 use active listening skills to interpret main ideas and the relevancy of supporting details

Section Three:
Specific Curriculum Outcomes

Exploring Our World

Focus

Play and inquiry-based learning are the foundations of the science kindergarten curriculum.

In indoor and outdoor learning environments rich in materials to explore, and with appropriate support and guidance, students can be led to develop confidence in questioning, problem identification, planning, observing, analyzing, communicating, and collaborating. In the process, they learn to bring focus to activities, develop language to express and expand upon their ideas, actions, and experiences, and develop understandings about objects and events.

Outcomes Framework

For Science K-3, the specific curriculum outcomes for GCO 1 STSE and GCO 3 Knowledge are combined into a single outcome stream: **STSE/Knowledge [GCO 1/3]**.

GCO 1 (STSE): Students will develop an understanding of the nature of science and technology, of the relationships between science and technology, and of the social and environmental contexts of science and technology.

GCO 3 (Knowledge): Students will construct knowledge and understandings of concepts in life science, physical science, and Earth and space science, and apply these understandings to interpret, integrate, and extend their knowledge.

Students are expected to

- 1.0 demonstrate curiosity and wonder
- 2.0 explore, investigate, and solve problems
- 6.0 explore ways to use tools
- 8.0 develop vocabulary and use language to bring meaning to observations
- 9.0 detect consistency and pattern in objects and events
- 11.0 explore and select different ways to represent ideas, actions, and experiences and to communicate with others

GCO 2 (Skills): Students will develop the skills required for scientific and technological inquiry, for solving problems, for communicating scientific ideas and results, for working collaboratively, and for making informed decisions.

Students are expected to

3.0 pose questions that lead to exploration and investigation
4.0 identify problems to be solved
5.0 select and use materials to carry out their own explorations and investigations
7.0 make observations
10.0 sequence or group materials and objects
12.0 communicate while exploring and investigating

GCO 4 (Attitudes): Students will be encouraged to develop attitudes that support the responsible acquisition and application of scientific and technological knowledge to the mutual benefit of self, society, and the environment.

Students are encouraged to

- recognize the role and contribution of science in their understanding of the world
- show interest in and curiosity about objects and events within their immediate environment
- willingly observe, question, and explore
- consider their own observations and ideas when drawing a conclusion
- appreciate the importance of accuracy
- be open-minded in their explorations and investigations
- work with others in exploring and investigating
- be sensitive to the needs of other people, other living things, and the local environment

SCO Continuum

The Science Kindergarten curriculum is curiosity-driven; **learning experiences are not prescribed**. In Science 1-3, however, students develop prescribed knowledge and understandings of concepts in life science, physical science, and Earth and space science.

GCO 1 (STSE): Students will develop an understanding of the nature of science and technology, of the relationships between science and technology, and of the social and environmental contexts of science and technology.

GCO 3 (Knowledge): Students will construct knowledge and understandings of concepts in life science, physical science, and Earth and space science, and apply these understandings to interpret, integrate, and extend their knowledge.

Science Kindergarten		Science 1	Science 2	Science 3
Exploring Our World	1.0 demonstrate curiosity and wonder 2.0 explore, investigate, and solve problems 6.0 explore ways to use tools 8.0 develop vocabulary and use language to bring meaning to observations 9.0 detect consistency and pattern in objects and events 11.0 explore and select different ways to represent ideas, actions, and experiences and to communicate with others	*Daily and Seasonal Changes*	*Air and Water in the Environment*	*Exploring Soils*
		Materials and Our Senses	*Solids and Liquids*	*Materials and Structures*
		Properties of Objects and Materials	*Relative Position and Motion*	*Invisible Forces*
		Needs and Characteristics of Living Things	*Animal Growth and Changes*	*Plant Growth and Changes*

GCO 2 (Skills): Students will develop the skills required for scientific and technological inquiry, for solving problems, for communicating scientific ideas and results, for working collaboratively, and for making informed decisions.

	Science Kindergarten	Science 1-3
Exploring Our World	3.0 pose questions that lead to exploration and investigation	• pose questions that lead to exploration and investigation
	4.0 identify problems to be solved	• identify problems to be solved
	5.0 select and use materials to carry out their own explorations and investigations	• select and use materials to carry out their own explorations and investigations • follow a simple procedure • use appropriate tools for manipulating materials
	7.0 make observations	• make and record observations and measurements
	10.0 sequence or group materials and objects	• sequence or group materials and objects
	12.0 communicate while exploring and investigating	• communicate using scientific terminology • communicate while exploring and investigating • respond to the ideas and actions of others in constructing their own understanding

Demonstrating Curiosity and Wonder

Outcomes

Students will be expected to

1.0 demonstrate curiosity and wonder
[GCO 1/3]

2.0 explore, investigate, and solve problems
[GCO 1/3]

Cross-Curricular Connections

SEL

Developing a positive self concept is rooted in awareness of personal interests. Recognizing and respecting the diverse interests of others develops social awareness. (Refer to SEL GCOs 1, 6, 7)

Self-management and relationships skills develop as students collaboratively pursue answers to inquiry questions and solutions to problems, and practice playing and working together respectfully. (Refer to SEL GCOs 5, 9)

Social Studies

- Inquiry processes and skills.

Focus for Learning

"Scientists have one thing in common with children: curiosity."
Otto Robert Frisch

Children have a natural playfulness, curiosity, and sense of wonder about the world around them; a desire to explore and investigate, see inside things, find out how things work, and find answers to their questions or problems. Nurture this innate curiosity and wonder to spark questioning and meaningful, purposeful, student-driven inquiry.

The Kindergarten science curriculum is curiosity-driven. The objects and events that students are interested in become the focus of learning experiences to address curriculum expectations within a play- and inquiry-based environment. As a result, the learning experiences in each classroom will be unique.

Create opportunities for students to play in indoor and outdoor environments with varied, flexible, and responsive learning areas and materials. Participate in and observe students' play, notice their interests, and listen to their conversations. Ask open-ended questions to reveal their thinking and wonderings. Reflect and respond by employing different strategies (e.g., provocations) to invite students to engage in inquiry and problem solving, based on their interests.

Science learning experiences will vary based on students' interests and curiosity, however, the consistent focus will emphasize

- science inquiry - addressing questions about objects and events, involving broad explorations and focused investigations; and
- problem solving - seeking solutions to practical problems or addressing needs by applying their learning to design and build prototypes of products and processes.

Students are expected to be scientists and engineers; to actively engage in ongoing cycles of independent and collaborative exploration, investigation, and problem solving, of their choosing.

The best questions and problems are those derived from and driven by students' authentic curiosity and wonder. Encourage, welcome, and invite them to independently pursue these ideas. As they engage with inquiry and problem solving, and reflection, learning, and rethinking occurs, new questions and problems to explore, investigate, and solve will arise.

Create and cultivate opportunities for students to develop the skills required for science inquiry, solving problems, communicating scientific ideas and results, and working collaboratively.

Attitudes

Encourage students to

- show interest in and curiosity about objects and events within their immediate environment, and
- recognize the role and contribution of science in their understanding of the world. [GCO 4]

Demonstrating Curiosity and Wonder

Sample Teaching and Assessment Strategies

Activation

Teachers may

- Use children's literature to spark students' curiosity, wonder, inquiry, and problem solving.
- Discuss what being curious looks and feels like.
- Co-create with students a common shared space to value and post their questions and problems (e.g., Wonder Wall). Revisit the space often and encourage students to add, share, and discuss their observations, learnings, and new questions and problems.

Students may

- Engage in open, free play, both indoors and outdoors; playing with and demonstrating curiosity about objects and events.

Connection

Teachers may

- Create provocations to elicit student curiosity and wonder.
- Notice and name when students demonstrate curiosity and wonder, and document for assessment purposes.
- Model and encourage students to think aloud during play.
- Encourage exploration of outdoor environments during play, using the mentor text *The Earth Gives More.*
- Explore curiosity and wonder using the mentor text *What Could That Be?;* acknowledging that different individuals have different wonderings, ideas, and interests. Afterwards, introduce unfamiliar objects to learning areas and ask students to share their wonderings about what the objects could be.
- Make connections to the importance of working together using mentor texts with collaboration themes (e.g., *Penguinaut*, *The Little Red Fort*).
- Notice and name when students engage in aspects of science inquiry and problem-solving (design and build) processes (e.g., exploring, observing, questioning, planning, discovering, sharing). Refer to the Resource Links for elaboration of these processes.

Students may

- Use a variety of technologies (e.g., notepads, sticky notes, digital images) to document their wonderings, observations, and learning for posting in the common shared space.
- Engage in an outdoor "curiosity hunt"; bringing back to class objects that spark curiosity. The object may be captured digitally.
- Play with coding-related toys and technologies that develop their problem-solving abilities.

Resources and Notes

Supplementary

THINQ Kindergarten: inquiry-based learning in the kindergarten classroom
(Teacher's Resource [TR])

- pp. 1-20
- Provocations, pp. 29-40
- Wonder Walls, p. 30
- The Inquiry Process, p. RE3

Science Kindergarten Children's Literature

- *Penguinaut*
- *The Earth Gives More*
- *The Little Red Fort*
- *What Could That Be?*

Suggested

Resource Links: www.k12pl.nl.ca/curr/k-6/sci/sci-k/links.html

- Inquiry process
- Problem-solving process (Design and builds)

Other Curriculum Resources

- *Explorations: Learning Through Inquiry and Play* (Full-Day Kindergarten Teacher's Resource [FDK-TR])
  - Guiding principles, pp. 3-15

Initiating Science Inquiry and Problem Solving

Outcomes

Students will be expected to

3.0 pose questions that lead to exploration and investigation [GCO 2]

4.0 identify problems to be solved [GCO 2]

Cross-Curricular Connections

English Language Arts

- Ask questions to seek more information. (SCO 1.3)

Mathematics

- Mathematical processes - problem solving.

Social Studies

- Inquiry process and skills.

Focus for Learning

Science inquiry begins with a question. Posing science inquiry questions is a complex skill that will be developed over the course of the K-3 science curriculum. It involves

- understanding what questions are;
- understanding that different kinds of questions are used for different purposes; and
- asking different kinds of questions in different situations, including questions that lead to science inquiry.

(adapted from https://letstalkscience.ca/educational-resources/learning-strategies/questioning)

In Kindergarten, establish a foundation for this skill. Focus on developing understanding of what questions are and demonstrating how to ask them. Notice and name when students ask questions in everyday contexts. Invite questions about objects and events of interest to them. Model how initial questions can lead to science inquiry explorations and investigations.

Problem solving begins with identifying a problem. The skill of problem identification will be developed over the course of the K-3 science curriculum and involves

- understanding that problems arise from needs and wants;
- understanding that solutions to problems may be products (physical objects) or processes (a better way to do something);
- recognizing that initial problems may require clarification to be solved; and
- students having a clear, common understanding of their goal (i.e., requirements, constraints, criteria) and being able to identify what is important in devising a solution to the problem/need.

(adapted from https://letstalkscience.ca/educational-resources/learning-strategies/problem-identification)

The foundation for this skill is established in Kindergarten. Let students hear you thinking aloud about problems/needs encountered and how you might solve or address them. Notice and name when students communicate problems/needs in different situations.

Problems to solve can arise from different sources (e.g., children's literature, classroom or home experiences, provocations). Provoke students to engage in individual and collaborative problem solving; considering how they might solve a problem and whether they need to design and build a product or find a better way of doing something.

Attitudes

Encourage students to

- show interest in and curiosity about objects and events within their immediate environment. [GCO 4]

Initiating Science Inquiry and Problem Solving

Sample Teaching and Assessment Strategies

Activation

Teachers may

- Introduce provocations, based on observed student interests, to spark individual and collaborative inquiry and problem solving.
- Use mentor texts to spark science inquiry (e.g., *And Then the Seed Grew, At The Pond*) and design and build problem solving (e.g., *Billy Bloo is Stuck in Goo, Not a Box, Penguinaut, The Little Red Fort, The Most Magnificent Thing*).

Connection

Teachers may

- Adopt the stance of co-learner, expanding upon and extending students' initial questions and problems/needs, to invite them to engage in science inquiry and problem solving.
- Develop student understanding of questions, using the mentor text *Which is Round? Which Is Bigger?.*
- Ask students to identify the problem/need arising in mentor texts (e.g., *And Then the Seed Grew*, *Billy Bloo is Stuck in Goo*, *Penguinaut*, *Ten Birds Meet a Monster, The Little Red Fort*, *The Most Magnificent Thing*) and discuss possible solutions.
- Be open to inquiries and design and builds that develop naturally from students' questions or problems/needs.

Students may

- Collaboratively brainstorm solutions to problems identified in classroom experiences (e.g., wet mittens after outside play).

Consolidation

Teachers may

- Visually document individual and collaborative inquiry and problem solving and post in the common shared space for discussion.
- Highlight stages of design and build processes (e.g., planning) in mentor texts (e.g., *Penguinaut, The Little Red Fort, The Most Magnificent Thing*).
- Ask open-ended questions that align with stages of science inquiry and design and build processes.

Students may

- Engage in independent and collaborative science inquiry and problem solving, including design and builds.
- Identify problems to be solved when using coding-related toys and technologies.

Resources and Notes

Supplementary

THINQ Kindergarten: inquiry-based learning in the kindergarten classroom (TR)

- pp. 21-40
- Questioning, p.97
- The Inquiry Process, p. RE3

Science Kindergarten Children's Literature

- *And Then the Seed Grew*
- *At The Pond*
- *Billy Bloo is Stuck in Goo*
- *Penguinaut*
- *Ten Birds Meet a Monster*
- *The Little Red Fort*
- *The Most Magnificent Thing*
- *Which is Round? Which is Bigger?*

Suggested

Resource Links: www.k12pl.nl.ca/curr/k-6/sci/sci-k/links.html

- Questioning
- Identifying problems
- Inquiry process
- Problem-solving process (Design and builds)

Other Curriculum Resources

- *Not a Box* (Nelson Literacy Kit - What is it Made Of?, English Language Arts K)
- *Explorations: Learning Through Inquiry and Play* (FDK-TR)

Planning and Carrying out Science Inquiry and Problem Solving

Outcomes

Students will be expected to

5.0 select and use materials to carry out their own explorations and investigations [GCO 2]

6.0 explore ways to use tools [GCO 1/3]

Cross-Curricular Connections

SEL

A positive growth mindset develops self-confidence, supports risk taking, and builds the stamina, self-discipline, and perseverance required to pursue individual and collaborative inquiry and problem solving.
(Refer to SEL GCOs 1, 5)

Making informed choices and decision-making skills are practiced when selecting materials and exploring ways to use tools.
(Refer to SEL GCO 11)

Focus for Learning

Once students decide to pursue a science inquiry question or problem, planning is a next step. Planning is a thinking skill that involves identifying methods, selecting materials, and devising a sequence of steps (i.e., procedure) to accomplish a task. In Kindergarten, student planning should focus on selecting and using materials to carry out their inquiries and problem solving.

Materials refer broadly to anything required to carry out an exploration, investigation, or design and build (e.g., natural and constructed materials and objects, tools, instruments, access to experts, print materials, and Internet resources). Materials placed in the learning environment should change over time to reflect the specific inquiries or problem solving activities students are currently engaging in.

Provide access to a variety of different materials for students to select from so that they can pursue their ideas independently. Include students in the organization of the materials in the classroom. Encourage, welcome, and invite them to suggest or provide additional materials and incorporate materials from other learning areas.

Individuals engaged in science and engineering use tools (technologies) to help them investigate questions and solve problems.

When engaged in play or pursuing science inquiry and design and builds, students should select tools (including their hands) and identify and explore ways to use them to carry out useful tasks.

Provide ready access to age-appropriate tools in all learning areas and environments (e.g., art tools, building/construction tools, dramatic play tools, observation tools [binoculars, flashlight, magnifying lens, mirror], outdoor play tools, sand/water play tools, writing and representing tools). Notice and name when students use tools to help them carry out everyday tasks.

Safe use of some tools may require modelling.

Attitudes

Encourage students to

- be open-minded in their explorations and investigations. [GCO 4]

Planning and Carrying out Science Inquiry and Problem Solving

Sample Teaching and Assessment Strategies

Activation

Teachers may

- Create a "Wonder Wagon or "Wonder Crate" for outdoor play. Each day, prior to going outside, ask students to add materials they plan to play with or use.

Connection

Teachers may

- Highlight planning and tool use in mentor texts (e.g., *Penguinaut, The Little Red Fort, The Most Magnificent Thing*).
- Present unfamiliar tools and ask what they might be used for.
- Play games that encourage students to suggest other possible uses for familiar tools (e.g., This is not a spatula. This is a ...).
- Discuss the importance of failure and perseverance in problem solving using the mentor text *The Most Magnificent Thing.*
- Encourage students to bring outdoor materials (e.g., leaves, snow) into the classroom for further exploration and investigation.

Students may

- Brainstorm materials they would take for different learning experiences, for example, to play in the sand box.
- Identify tools used during class visits to work environments within the school and community.
- Design and personally construct objects using Makedo™ tools.
- Manipulate materials using sand/dough tools.

Consolidation

Teachers may

- Establish design criteria (i.e., solution characteristics) and constraints (e.g., materials, time) to encourage critical thinking during design and builds.

Students may

- Select and use materials to, for example,
  - explore raindrops (*At The Pond*),
  - investigate seeds and seedlings (*And Then the Seed Grew*),
  - build forts for different contexts (*The Little Red Fort),*
  - free an object, such as a Lego™ minifigure, from slime (*Billy Bloo is Stuck in Goo),*
  - construct a device to scare away monsters (*Ten Birds Meet a Monster),* or
  - construct a spaceship (*Penguinaut*).
- Design and construct tools for personal use (e.g., 3D printed).

Resources and Notes

Supplementary

THINQ Kindergarten: inquiry-based learning in the kindergarten classroom (TR)

- pp. 41-57
- Planning, p. 98

Science Kindergarten Children's Literature

- *At The Pond*
- *And Then the Seed Grew*
- *Billy Bloo is Stuck in Goo*
- *Penguinaut*
- *Ten Birds Meet a Monster*
- *The Little Red Fort*
- *The Most Magnificent Thing*

Suggested

Resource Links: www.k12pl.nl.ca/curr/k-6/sci/sci-k/links.html

- Planning
- Inquiry process
- Problem-solving process (Design and builds)

Other Curriculum Resources

- *Explorations: Learning Through Inquiry and Play* (FDK-TR)
  - Creating responsive learning areas, pp. 26-35
  - Suggested materials by learning area, pp.112, 140, 168, 250, 274
- *Beautiful Stuff!: Learning with Found Materials* (Health Kindergarten)

Making Observations

Outcomes

Students will be expected to

7.0 make observations [GCO 2]

8.0 develop vocabulary and use language to bring meaning to observations [GCO 1/3]

Cross-Curricular Connections

SEL

Relationship skills develop as students share their personal observations with others and practice active listening. (Refer to SEL GCO 9)

English Language Arts

- Participate in conversations. (SCO 2.1)
- Share information, ideas, and opinions orally. (SCO 2.2)

Focus for Learning

The skill of observing involves using the senses to find out about the attributes or behaviours of objects and events. Information gathered enables individuals to make inferences and construct knowledge about the world around them. Observations can be unaided, made directly with the senses, or aided by tools and techniques that enhance or extend our capacity to observe.

Create and cultivate opportunities for students to make observations as they play, explore, investigate, and solve problems. Model and encourage students to

- make detailed observations;
- observe using one or a combination of senses;
- make visual observations from different perspectives;
- use tools such as binoculars, flashlights, magnifying lenses, microscopes, mirrors, and mobile device applications (e.g., audio recorder, camera) to enhance and extend their observations;
- record observations, using various methods (e.g., digital images, illustrations, labelling, note-taking, object displays, video) for future analysis and interpretation; and
- use personal observations when describing objects and events.

Individuals engaged in science and engineering use precise and consistent vocabulary and language when communicating.

Students should develop vocabulary and language to bring meaning to their observations of objects and events; to describe the attributes or behaviours they see, feel, smell, hear, and taste. Specific vocabulary developed will vary based on students' interests. Notice and name when students use specific vocabulary. Introduce and encourage the adoption of new vocabulary as the need emerges, providing opportunities for students to hear it and see it used in context.

Additionally, as students explore, investigate, and solve problems, encourage development of vocabulary and language associated with science processes and skills (e.g., question, problem, plan, materials, tools, observe, record).

Attitudes

Encourage students to

- willingly observe, question, and explore, and
- appreciate the importance of accuracy. [GCO 4]

Making Observations

Sample Teaching and Assessment Strategies

Connection

Teachers may

- Read aloud *At The Pond*. Invite students to share their initial observations and questions and revisit how those questions can lead to science inquiry.
- Discuss ways to enhance and extend observations (e.g., using observation tools, different perspectives, more than one sense).
- Provide access to observation tools in indoor and outdoor learning areas. Include paper tube viewers, picture frames, and hula hoops to focus observations.
- Provide daily opportunities for detailed observation of natural objects and events in indoor and outdoor learning environments.
- Read aloud the mentor text *The Earth Gives More* and discuss the natural objects and events that students might see, hear, smell, and feel during play in outdoor learning areas.
- Discuss perspective using the text *How to Heal a Broken Wing* (i.e., only the boy sees the bird because he was looking down).
- Encourage students to think critically about personal observations using the mentor text *Which is Round? Which is Bigger?.*
- Provide access to a variety of materials and tools for students to record their personal observations (e.g., art supplies, clipboards, mobile device applications, notepads).

Students may

- Bring natural objects into the classroom to observe in detail.
- Use observation tools and techniques during daily play and when exploring and investigating.
- Record personal observations (e.g., notepad illustrations, digital pictures) and post them to the common shared space.

Consolidation

Teachers may

- Document student observations and learning and post them in the common shared space for whole group discussion.
- Place a frame on the classroom window. Invite students to observe through the Wonder Window and record observations of the attributes and behaviours of natural objects and events.

Students may

- Engage in daily conversations about posts in the common shared space.
- After reading *At the Pond*, select a natural area to observe repeatedly over a period of time and record their observations.
- Describe the attributes or behaviours of objects and events using specific vocabulary.

Resources and Notes

Supplementary

THINQ Kindergarten: inquiry-based learning in the kindergarten classroom (TR)

- Wonder Window, p. 36
- Observing, p. 99

Science Kindergarten Children's Literature

- *At the Pond*
- *The Earth Gives More*
- *Which is Round? Which is Bigger?*

Suggested

Resource Links: www.k12pl.nl.ca/curr/k-6/sci/sci-k/links.html

- Observing
- Using appropriate vocabulary
- Inquiry process
- Problem-solving process (Design and builds)

Other Curriculum Resources

- *How to Heal a Broken Wing* (Nelson Literacy Kit - Living Things in the Environment, English Language Arts K)
- *Explorations: Learning Through Inquiry and Play* (FDK-TR)

Identifying Pattern and Order

Outcomes

Students will be expected to

9.0 detect consistency and pattern in objects and events [GCO 1/3]

10.0 sequence or group materials and objects [GCO 2]

Cross-Curricular Connections

Mathematics

- Use direct comparison to compare two objects based on a single attribute. (SCO KSS1)
- Sort 3-D objects using a single attribute and explain the sorting rule. (SCO KSS2)
- Demonstrate an understanding of repeating patterns... (SCO KPR1)

Focus for Learning

We make sense of the world around us by analyzing and interpreting our observations to detect patterns and order. We detect consistency (sameness, matching, unchanging), repetition, and trends in the attributes and behaviours of objects and events. Note, detecting pattern is broader than the repeating pattern focus of the Mathematics curriculum. It includes noting, for example, leaves with matching shapes, the coiled spiral of snail shells, and that moistened seeds germinate while dry seeds do not.

When engaged in play or pursuing science inquiry or problem solving, prompt students to look for consistency and pattern in the objects and events they observe. When playing with Lego™, for example, students might note consistency in attributes such as brick colour, shape, and size, and pattern in the number and arrangement of studs on top of bricks (e.g., 2x2, 2x3, 2x4) or cylinders on the bottom.

Patterns of change in attributes or behaviours (e.g., growth of seedlings, behavioural patterns in a class pet) may be detected through repeated observations, over a period of time.

Detecting consistency and pattern in observations is foundational to the development of science-related skills such as predicting, grouping, comparing, sequencing, and classifying.

In Kindergarten, focus on the skills of grouping and sequencing objects according to one or more attributes (e.g., colour, size, shape, texture, use) or behaviours. Developmentally, these skills involve

- observing and describing the attributes/behaviours of objects using specific vocabulary;
- identifying objects that match based on the sameness of an attribute/behaviour (consistency);
- grouping (sorting) different objects based on the sameness of one or more attributes/behaviours;
- comparing objects with respect to the amount or level of an attribute/behaviour they hold; and
- sequencing (ordering) objects according to increasing or decreasing amounts of an attribute/behaviour.

When observing objects as part of play, science inquiry, or problem solving, prompt students to engage in purposeful matching, grouping, comparing, and sequencing activities.

Attitudes

Encourage students to

- consider their own observations and ideas when drawing a conclusion, and
- appreciate the importance of accuracy. [GCO 4]

Identifying Pattern and Order

Sample Teaching and Assessment Strategies

Activation

Teachers may

- Identify and discuss patterns in art, children's literature, movement, and music.

Connection

Teachers may

- Notice and name consistencies and patterns detected by students, and document for assessment purposes.
- Read aloud the mentor text *Different? Same!* On each spread, ask students to identify the attribute or behaviour that the group of seemingly different animals have in common (consistency). Additionally, students may notice that one animal from each group also appears on the following spread with three new animals (pattern).
- Create provocations, based on student interests, that invite them to match, group, compare, and sequence objects.
- Share time-lapse videos to illustrate patterns of change.
- Provide ready access to materials that support grouping activities (bins, hula hoops, ice cube trays).

Students may

- Engage with matching games and Spot the Difference puzzles.
- Detect patterns such as stripes, spots, waves, and spirals in natural and constructed objects (e.g., fabrics, wallpaper).
- Compare and discuss the attributes of object pairs in the mentor text *Which is Round? Which is Bigger?*
- Sequence beakers or measuring spoons according to size.

Consolidation

Teachers may

- Provide paint chips or crayons and invite students to find objects with the same colour during outside play.

Students may

- Detect consistency and pattern in collections of natural objects (e.g., leaves, rocks, seashells, tree cones).
- Post representations of personal grouping and sequencing activities in the common shared space for discussion.
- Play *Which One Doesn't Belong?*, justifying the object from a set of four that is unique, based on its attributes or behaviours.
- Observe a set of objects (e.g., three different plastic animals) and use a provided data table to compare their attributes and behaviours (e.g., number of legs, presence of tail, body covering).

Resources and Notes

Supplementary

Science Kindergarten Children's Literature

- *Different? Same!*
- *Ten Birds Meet a Monster*
- *Which is Round? Which is Bigger?*

Suggested

Resource Links: www.k12pl.nl.ca/curr/k-6/sci/sci-k/links.html

- Analyzing and interpreting
- Comparing and contrasting
- Sorting and classifying
- Thinking in patterns (videos)

Other Curriculum Resources

- *Which One Doesn't Belong? Playing with Shapes* (Mathematics K)
- *Explorations: Learning Through Inquiry and Play* (FDK-TR)

Communicating and Collaborating

Outcomes

Students will be expected to

11.0 explore and select different ways to represent ideas, actions, and experiences and to communicate with others
[GCO 1/3]

12.0 communicate while exploring and investigating
[GCO 2]

Cross-Curricular Connections

SEL

Social awareness develops as students recognize and respect different ways of representing and communicating with others. (Refer to SEL GCOs 6, 7)

Relationship skills develop as students practice active listening and work and play respectfully together. (Refer to SEL GCO 9)

English Language Arts

- Participate in conversations. (SCO 2.1)
- Share information, ideas, and opinions orally. (SCO 2.2)
- Express feelings and imaginative ideas through writing and representing. (SCO 8.1)
- Explore writing and representing processes. (SCO 10.1)

Mathematics

- Mathematical processes - communication.

Social Studies

- Communication, inquiry, and participation processes and skills.

Focus for Learning

Individuals who engage in science and engineering communicate with varied audiences for varied purposes.

Model and provide opportunities for students to explore different ways of representing and communicating with others. Using, for example, oral and written language, charts, diagrams, gestures, illustrations, models, object displays, photographs, physical demonstrations, scribbles, sounds, symbols, video, and visual arts.

Allow students to use the form of representation and communication they are most comfortable and confident using. This enables them to focus on the idea, action, or experience being conveyed. Over time, exposure and exploration may encourage them to use different forms.

Effective communication is essential at every stage of science inquiry and problem-solving processes. In Kindergarten, the focus is on student communication while carrying out their explorations, investigations, and problem solving.

Use strategies and tools to encourage students to share with others their wonderings, ideas, actions, intentions, and observations. The use of small and whole group collaborative inquiry and problem solving, for example, encourages communication and develops the skills required for communicating scientific ideas and results and working collaboratively.

Vocabulary development and language use are interrelated with the skill of communication.

Attitudes

Encourage students to

- work with others in exploring and investigating, and
- be sensitive to the needs of other people, other livings things, and the local environment. [GCO 4]

Communicating and Collaborating

Sample Teaching and Assessment Strategies

Connection

Teachers may

- Co-create indoor and outdoor spaces for students to share their learning with others.
- Incorporate science-related materials into dramatic play areas. This enables students to play roles of individuals engaged in science and engineering and engage in conversations corresponding to those roles.
- Ensure ready access to any materials students might need to communicate and represent their learning.
- Encourage students to think aloud when engaged in science inquiry and problem solving.
- Take on the role of co-learner in collaborative inquiry and problem solving, to engage students in conversation about their ideas, actions, and experiences.
- Notice and name when students use different forms of representation and communication, and document use for assessment purposes.
- Provide a variety of audiences with whom students can communicate.
- Provide daily opportunities during which students share and listen to each other's ideas, actions, and experiences with respect to their individual and collaborative inquiry and problem solving.

Students may

- Brainstorm different ways to represent and communicate learning.
- Identify exemplars of different forms of representation in children's literature.
- Communicate using specific vocabulary.
- Post representations of their learning in the common shared space for discussion.

Consolidation

Teachers may

- Document and display evidence of students' individual and collaborative inquiry and problem solving.
- Engage students in whole group conversations about their learning.

Students may

- Ask questions and seek advice and opinions from others to further their independent and collaborative inquiries and to learn about the inquiries of others.

Resources and Notes

Supplementary

THINQ Kindergarten: inquiry-based learning in the kindergarten classroom (TR)

- Communicating, p. 99

Suggested

Resource Links: www.k12pl.nl.ca/curr/k-6/sci/sci-k/links.html

- Communication
- Working collaboratively

Other Curriculum Resources

- *Explorations: Learning Through Inquiry and Play* (FDK-TR)
  - Sharing and communicating learning, pp. 12-13

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